

S U R R O

Swiss Uphill Running test for Runners and Orienteers

Individual differences in uphill vs. horizontal running capacity in elite runners and orienteers, including junior athletes

Sport specific performance testing for uphill running.

Eidgenössische Sportkommission (ESK)
Forschungsprojekt von 01.01.2006 - 31.07.2008

Schlussbericht

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Overview

The purpose of the SURRO-Project was to develop a sport specific performance test for orienteers that measured uphill running ability, and to gain knowledge on differences in horizontal versus uphill running ability in elite and youth orienteers. Initially, the SURRO-Project also served as a form of preparation for the Swiss national orienteering team for the 2005 World Orienteering Championships (WOC) in Japan. In Japan, the terrain is characterized as moderate to very steep and uphill running was to be a key factor of performance at this WOC. This type of sport specific performance testing not only aided the athletes in their own preparation for this WOC, but also added to the knowledge of the sport and the specific limiting factors of performance. Uphill running ability had not been widely investigated in the field of exercise science and the research question of this project was unique to the field. The results and further implication of this study have been shared through the diverse publications, poster presentations, magazine articles and feedback to the athletes. Consequently, in the sport of orienteering the uphill performance test has become a standard performance test completed yearly by the elite and junior national teams. Furthermore, the awareness of the importance of uphill running ability in orienteering has grown nationally and internationally due to this project.

Results, Publications and Athlete Feedback

1: Publication: Scientific Journal of Orienteering, November 2005

Uphill running capacity in Swiss elite orienteers.

Zürcher S, Clénin G and Marti B

Appendix 1

This article was based on the collected data with the Swiss national orienteering team (elite and junior) in 2005, which served as the pilot study for the ESK SURRO-Project. The following conclusions were made:

- Orienteers seem to have a greater running capacity uphill versus horizontal, which can have consequences on route choice making during a competition.
- Horizontal and uphill running ability do not strongly correlate.
- This uphill performance test gives an alternative to the standard horizontal lactate threshold test, which may be more specific to orienteering performance.

2: Poster for Trainerherbsttagung, November 2005

Uphill running capacity in Swiss elite orienteers.

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Appendix 2

This poster summarizes the results that were published in the Scientific Journal of Orienteering.

3: Athlete Feedback, June 2006

SURRO-Studie 1 Hauptergebnisse

Appendix 3

This document gave an overview of the results from the measurements made in 2005 and 2006 to the athletes of the Swiss national team. It was written as a feedback to the athletes and not as a scientific document. The following information was given to the athletes:

- Elite orienteers achieve in the maximal stage test at 22% incline a better performance (higher maximal speed when calculated with an equivalence factor into equivalent horizontal speed and higher maximal oxygen uptake) than in the horizontal maximal stage test. This finding indicated that the uphill test is better suited at measuring the running ability of orienteers.
- Running the uphill stage test 3 to 4 hours after the horizontal stage test did not produce different results in maximal speed, maximal heart rate, or maximal oxygen uptake than when the uphill stage test is completed without prior effort. Only maximal lactate concentration was lower in the uphill test with the prior effort of the horizontal test. This finding confirms that it is possible to test both horizontal and uphill running ability in one day, making it more convenient for the athlete and in a praxis setting.
- When comparing physiological parameters such as heart rate, blood lactate and rating of perceived exertion, as well as, maximal speed, we can conclude that the equivalence factor of climb to distance is about 6.5. Individual variation was seen to be between 6 and 7, and the commonly used equivalence factor of 10 appears, based on our results, to be too high.

4: Poster for European College of Sports Medicine Congress, Lausanne, June 2006.

Physiological Equivalence of horizontal versus uphill running: finding from junior and adult world class orienteers.

Zürcher S, Tschopp M, Clénin G, and Marti B.

Appendix 4

This poster summarizes the physiological comparison of horizontal versus uphill running in order to determine how much additional horizontal distance uphill running corresponds to [Equivalence Factor: EF]. The following conclusions were made:

- Within this sample of well trained male and female elite orienteers, we found a surprisingly consistent EF of about 6.5 at an incline of 22%, regardless of whether it was calculated from maximal speed or additional sub-maximal parameters.
- Individual variation in EF was broader, with values between 5.5 and 8.5, the former suggesting above average ability and the latter below average ability in uphill running for orienteers.
- This information provided individual feedback for the coaches and athletes, and can influence route choices made during an orienteering events. However, relying on a treadmill, the present study did not take into account potential outdoor difference in uphill vs. horizontal runability.
- Orienteers have specific running abilities that are different from track, or road runners. Their training, and consequently their physiological capacity, is adapted to the rough off trail running, as well as, to the demands of elevation gain and loss that is required in orienteering. The validity of the presently found EF of 6.5 should, therefore, be checked with additional runners, specifically trained for horizontal or uphill running.

5: Athlete Feedback, December 2006

Results of the step rate and step length analysis

Appendix 5

One variable measured in the comparison between uphill and horizontal running ability was the step rate and step length patterns at sub-maximal and maximal speeds. The results showed the following:

- Step length and step rate was reduced by 50% and 10%, respectively, in uphill running at comparable workloads to horizontal running. This stride pattern stayed constant regardless of running speed or sex of the athlete.
- Superior uphill running ability could not be explained by a specific step pattern (step length or step rate), either at sub-maximal or maximal speed.

6: Magazine Article: Fit for Life, October 2007

Hoch hinaus: Leistungsdiagnostik, SURRO- Studie Magglingen

Autorin: Brigitte Wolf

Appendix 6

A magazine article was written for Fit for Life in the October edition. This article describes the results of SURRO-Study 1 and its consequences for orienteering performance. It also gave some focus on uphill running ability in general and practical implications for mountain running.

7: Poster for the Trainerherbsttagung, November 2007

Uphill running ability in junior elite orienteers and a comparison to the results found in elite orienteers.

Zürcher S, Wehrli J, Marti B.

Appendix 7

SURRO-Study 2: In the second part of the SURRO-Project, we measured uphill running ability in junior orienteers (age 15-19 y.old). The results collected were then compared to the results found in SURRO-Study 1 (elite aged athletes). The following conclusion could be made:

- Individual differences in uphill running ability could be measured and a runner's profile (strong uphill runner, weak uphill runner) could be defined. Individual recommendation regarding route choice decisions could be made. The mean individual equivalence factor in junior orienteers was not different to those of the elite orienteers; absolute maximal running speed was however higher in the elite athletes.
- Speed at the anaerobic threshold is lower, yet heart rate is higher in the junior athletes than in the elite athletes.
- Maximal lactate concentration, maximal perceived rating of exertion, and maximal oxygen uptake were not different between junior and elite orienteers either maximal horizontal or uphill running; only maximal heart rate was higher in junior orienteers.
- As also seen in elite athletes, performing the uphill stage test 3 to 4 hours after the horizontal stage test did not produce different results in maximal speed, maximal heart rate, or maximal oxygen uptake than when the uphill stage test is completed without prior effort; only maximal lactate concentration was lower in the uphill test with the prior effort. Therefore, 2 tests-in-1 day is also possible with junior orienteers.

8: Publication: International Journal of Sports Medicine, Feb- July 2008 (accepted with revision; revision pending)

Uphill running ability in world class orienteers.

Zürcher S, Wehrli J, Marti B.

Appendix 8

SURRO-Study 1: International publication of the main findings from the first study.